Residuals Management in Florida

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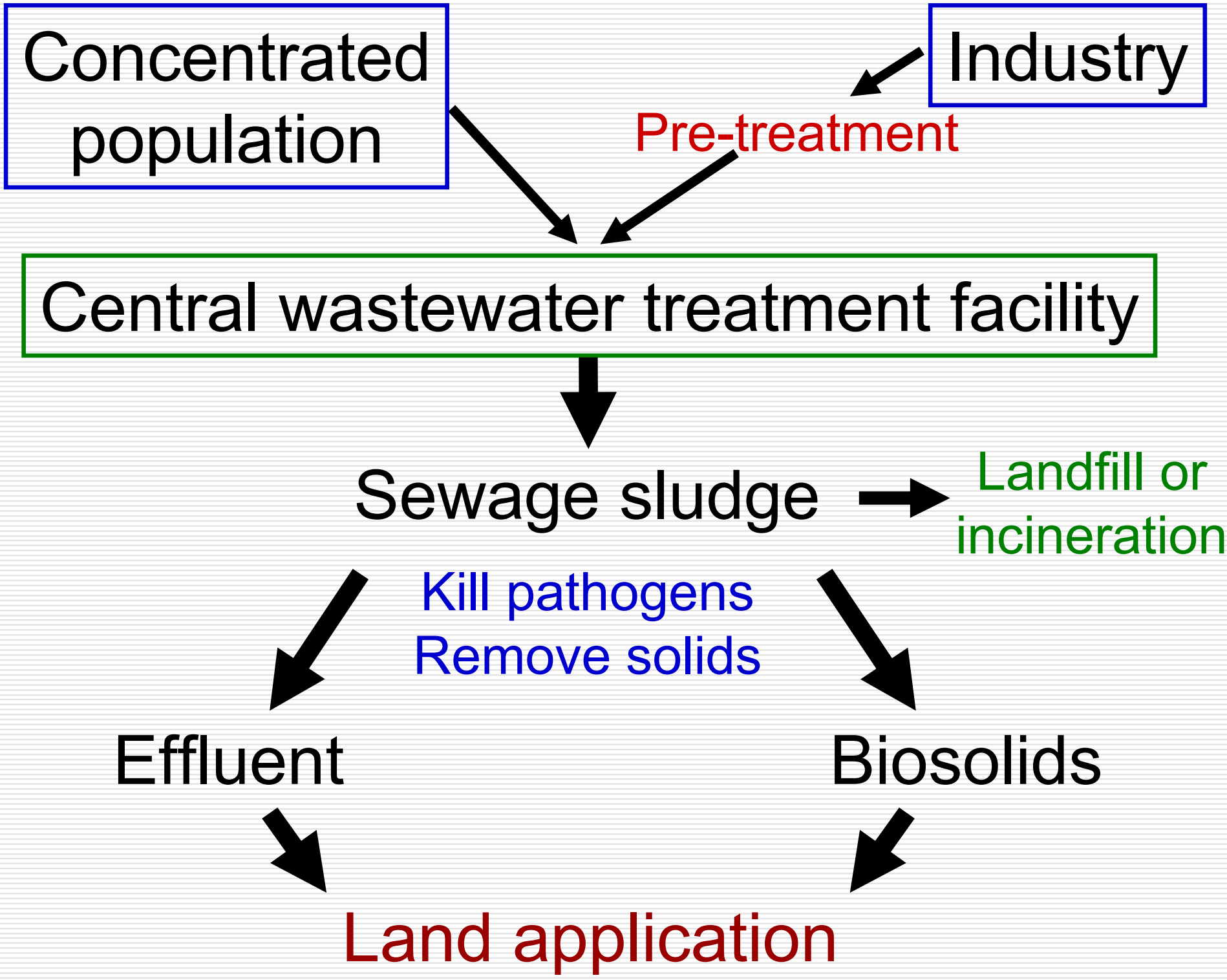
What are biosolids?

Definitions

- "Domestic wastewater residuals."
- The solid, cake, or liquid material generated during domestic wastewater treatment.
- Wastewater treatment produces effluent and residuals (a.k.a. sewage sludge, **biosolids**).


Concentrated population
Industry
Pre-treatment
Central wastewater treatment facility
Sewage sludge
Landfill or incineration
Kill pathogens
Remove solids
Effluent
Biosolids
Land application

Biosolids use

- 8 million dry tons produced nationally each year:
  - In 1988, 35% land-applied.
  - In 2003, 65% land-applied.
- In Florida:
  - 300,000 dry tons produced each year.
  - 83% used beneficially.
  - Additional 100,000 dry tons of Class AA pellets imported annually.

Biosolids classes in Florida

Class	Pathogen reduction	Pollutant limits	Ag use plan required?	Public access OK?
AA	Highest degree. (PFRP)	Highest standard. (EPA EQ)	No. (Non-restricted use)	Yes.
A	Highest degree. (PFRP)	Secondary standard.	Yes.	Yes.
B	Secondary standard. (PSRP)	Secondary standard.	Yes	After 1 year.

PSRP = Process to significantly reduce pathogens.

PFRP = Process to further reduce pathogens.

Biosolids characteristics

- Nutrient-rich, mostly organic material
- Useful as fertilizer or soil amendment
  - Improve and maintain productive soils.
    - Improves soil biological, chemical, and physical properties modestly
    - Slow-release nutrient source of N, S, P, and micronutrients
  - Harmless to human health or the environment when managed correctly
  - Carbon sequestration

Biosolids regulations

- Federal (EPA)
  - Title 40 CFR Part 503 (came from Clean Water Act).
- State
  - In Florida, the Fla. Dept. of Environmental Protection enforces Chapter 62-640, Florida Administrative Code.
- County
  - Variable; often, more restrictive

Federal “503” regs (1993)

- Biosolids metals concentration and maximum loading rates:
  - Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Zinc.
- Pathogen and vector attraction reduction
- Based on an extensive risk assessment and peer review (14 different exposure pathways)

Key differences between Florida laws and Federal regulations

- Florida requires Agricultural Use Plan (AUP) in facility permit.
- Special phosphorus considerations.
- Setbacks to water bodies and wells are greater than 503 regs.
- Public access to land treated with Class B biosolids restricted for 1 year.
- Slope requirements.
- Ground water depth requirements.
- Post signs.

How do regulations assure safety?

- Controls are in place to protect public health:
  - Prevent contact with pathogens
  - Limit potential pollutant/metals impacts
  - Limit potential nutrient impacts

Pathogen controls

- Pathogen reduction:
  - Class B – "PSRP" (significantly reduce)
  - Class A – "PFRP" (undetectable)
- Vector attraction reduction
- Site restrictions (Class B):
  - Limited public access, setbacks, harvesting and grazing restrictions, slope, groundwater, etc.

Pollutant controls

- Pollutant limits:
  - Ceiling limits (can't land apply if above)
  - Class AA limits (really clean biosolids)
- Cumulative limits (metals build-up at application site)
- Pre-treatment program

Biosolids metals limits (mg/kg)

Metal	Class AA ("EQ")	Ceiling for Class B
Arsenic	41	75
Cadmium	39	85
Copper	1500	4300
Lead	300	840
Mercury	17	57
Molybdenum	-	75
Nickel	420	420
Selenium	100	100
Zinc	2800	7500

Metals loading limits for Class B

Metal	Annual (kg/ha/yr)	Cumulative (kg/ha)
Arsenic	2.0	41
Cadmium	1.9	39
Copper	75	1500
Lead	15	300
Mercury	0.85	17
Molybdenum	-	-
Nickel	21	420
Selenium	5.0	100
Zinc	140	2800

Typical biosolids characteristics

Characteristic	Anaerobically digested	Lime stabilized
Solids (%)	25	25
Nitrogen (%)	5.6	3.8
Phosphorus (%)	2.2	1.0
Potassium (%)	0.2	0.4
Copper (ppm)	566	236
Molybdenum (ppm)	23	5
Zinc (ppm)	1484	321
Arsenic (ppm)	4	1
Cadmium (ppm)	11	4
Chromium (ppm)	91	10
Lead (ppm)	195	17
Nickel (ppm)	59	33
Mercury (ppm)	2	2
Selenium (ppm)	3	1
pH	8	12

Nutrient controls

- Agronomic application rate:
  - Prevent N leaching
  - Prevent P runoff
- Rate calculation based on:
  - Nutrient analysis of biosolids
  - Crop type
  - N-based or P-based

Land application practices in FL

- Primarily Class B biosolids.
- Pasture grass is the number one crop in Florida.
- Rates based on AUP.
- Potential problems as we move from N-based to P-based application rates.

Florida Science Issues

- Over-liming (lime stabilized biosolids)
- Phosphorus concerns

Over-liming

- Impacts on plants
  - Soil pH >”target pH” for plants
  - Fe and Mn deficiencies
- Factors to consider
  - Liming potential of biosolids
  - Lime requirement of soil/crop
  - Rate/frequency of application
  - Delayed response

Phosphorus Concerns

- P-based rates "silent killer"
- Biosolids-P research
  - Not all biosolids are the same!
  - Biosolids-P phytoavailability
    - Conventional ~50%; BPR ~100%
  - P leaching: low, but not inconsequential
  - P runoff: low
  - P hazard controllable with management:
    - Choice of biosolids, management, amendments, and soils amended

Phosphorus Concerns

- Draft Florida P-Index
  - Source coefficient (current):
    - 0.05 for fertilizer and manure
    - 0.015 for **all** biosolids
  - Revised source coefficient
    - Varies with biosolids source
- Biosolids-P restrictions - crop P need (~1 T/A)
  - Everglades protection area, Lake Okeechobee, Green Swamp area
- Biosolids-P ban
  - Lake Okeechobee and the St. Lucie and Caloosahatchee Estuaries.

Public concerns and complaints

- Nuisance concerns (trucks, odors)
- Health concerns (largely undocumented)
- Environmental concerns
- Effect on property values
- Unknown effects of biosolids constituents, especially PPCPs

County issues and ordinances

- Counties (mostly rural) are responding to public concerns.
- Decisions are made quickly under pressure, often based more on emotion than science.
- Once enacted, ordinances are difficult to change.

The future:
Possible regulatory changes

Concepts from county ordinances:

- Minimum of Class A or AA biosolids.
- Formal site permits.
- Increased site restrictions.
- Increased monitoring and reporting.
- Specific transportation requirements.

Possible regulatory changes: Revised 62-640 FAC

Philosophical

- Foster public confidence
- Encourage highest standards
- Better accountability
  - Site registration
  - Site Manager

Possible regulatory changes: Revised 62-640 FAC

- Practical
  - Nutrient Management Plans
    - P-Index
    - CCE of biosolids
    - Soil monitoring
  - Hydrology
    - Surface and ground water monitoring
    - Depth to seasonally high water table
    - 100-year floodplain

Possible regulatory changes: Revised 62-640 FAC - Continued

- Practical
  - Land application – Class B
    - "Precautionary" limit of 5 T/A
    - Incorporated or injected
      - Less than 12% solids
      - Alkaline treated
      - 100-year floodplain
    - Greater setbacks
    - More signage
    - Greater slope restrictions

Possible regulatory changes: Revised 62-640 FAC - Continued

- Practical
  - Class AA
    - No alkaline treated materials
    - Possible Mo value added to metals list
    - Preferred material

For more information……

- FL Dept. of Environmental Protection
  - http://www.dep.state.fl.us/water/wastewater/dom/reshome.htm
- National Biosolids Partnership
  - www.biosolids.org
- Water Environment Federation
  - www.wef.org

Current Status/Research Needs

- Agronomic issues
  - Fertility value largely understood
    - N availability measures need standardization and field validation
    - P availability currently being studied
    - Metals: understood
  - Liming value under appreciated

Current Status/Research Needs

- Environmental issues
  - Metals: understood
  - Organics: limited research underway
  - Pathogens: purview of EPA
  - Odors/bioaerosols: purview of EPA
  - Nutrients: P concerns **dominate**
    - P-Index needs field validation!

Phosphorus Concerns

- P-based rates "silent killer" of land application
- Biosolids-P research
  - Not all biosolids are the same!
  - Biosolids-P lability ~50% (30-100%) of fertilizer-P
  - P leaching: low, but not inconsequential
  - P surface runoff: low; sub-surface runoff: high
  - P hazard controllable with management:
    - Choice of biosolids, soils, management, and amendments

Phosphorus Concerns

- Draft Florida P-Index
  - Source coefficient:
    - 0.05 for fertilizer
    - 0.05 x 0.9 to 0.25 for biosolids
      - 0.9 for BPR/BPR-like
      - 0.5 for conventional
      - 0.25 for heat-dried, high Fe+Al materials
- Biosolids-P restrictions
  - Everglades protection area, Lake Okeechobee, Green Swamp area
- Biosolids-P ban
  - Lake Okeechobee and the St. Lucie and Caloosahatchee Estuaries.

Residuals Management Outlook

- Pessimist
  - Forced to produce costly Class AA
  - Forced to apply at impractically low rates
  - Politically enlarged areas of restrictions
- Optimist
  - Science-based guidelines
  - Recognition of quality, value, and safety
  - Sustainable land application (agronomic, environmental, and producer-based)